NATIONAL TRAINING CENTER

Protective Force Training Department

Standard Operating Procedure

Title:	Inclement Weather Training Restrictions
Number:	PFT-SOP-652
Revision:	1

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REVISION HISTORY

Rev.	Effective Date	Description of Revision
1	05/XX/09	First revision under new contractor approved.

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to ensure that (1) employees at the U.S. Department of Energy (DOE) National Training Center (NTC) are aware of inclement weather conditions that may pose a hazard to students, instructors, and visitors, and (2) such conditions do not result in personal injury or degradation of training. Attention to potentially hazardous weather conditions is especially important in connection with activities conducted outdoors at the NTC Live Fire Range (LFR) and Integrated Safety and Security Training and Evaluation Complex (ISSTEC).

2.0 SCOPE

This SOP outlines responsibilities that are applicable to NTC employees. Students and visitors are also responsible for complying with the inclement weather restrictions described in this SOP and with safety instructions provided by their instructors or escorts.

3.0 CANCELLATION

This procedure supersedes NTC SOP 552, Inclement Weather Training Restrictions, dated August 2007.

4.0 REFERENCES

4.1 10 CFR 851, Worker Safety and Health Program

4.2 DOE Guide 450.4-1B, Integrated Safety Management System Guide

4.3 DOE Manual 470.4-3A, Contractor Protective Force

4.4 National Weather Service Wind Chill Hazard Guidelines

4.5 National Weather Service Heat Index Program

4.6 377th ABW Weather Squadron Automated Weather Observation System

4.7 Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices, American Conference of Governmental Industrial Hygienists (ACGIH)

5.0 DEFINITIONS

None

6.0 POLICY

It is the policy of the NTC to ensure all training is conducted in environmental conditions that are conducive to learning and do not subject students and staff to weather-related hazards. NTC policy requires its Instructors to be fully aware of active, or potential, weather conditions that might result in a degraded learning environment or result in injury to students or staff, and to postpone or cancel training activities when potentially hazardous weather conditions exist.

7.0 RESPONSIBILITIES

Although each individual is responsible for his or her duties listed in this section, these duties may be delegated to another individual who is equally qualified to perform the same function.

7.1 DOE/NTC Director

7.1.1 Ensures this document is available to all DOE/NTC staff.

7.1.2 Requires DOE/NTC staff to read and adhere to this document, as appropriate to their area(s) of responsibility.

7.2 NTC General Manager

The NTC General Manager is responsible for ensuring all training conducted at the NTC is conducted safely in an environment that is conducive to learning and free from inclement weather hazards.

7.3 ESH&QA Director

7.3.1 Ensure operations are reviewed/surveyed periodically by appropriate personnel to ensure the requirements of this SOP are being fully implemented.

7.3.2 Ensure risk analysis reports adequately address weather-related hazards.

7.3.3 Ensure that the requirements of this SOP are properly implemented.

7.3.4 Assign a Safety Specialist to monitor weather to assure NTC staff and students are not subjected to dangerous weather conditions.

7.4 LFR and ISSTEC Management

7.4.1 Ensure all training is conducted in an environment that promotes a good learning environment and is free from inclement weather hazards.

7.4.2 Ensure staff members, as applicable, read this SOP and formally acknowledge their understanding of its contents.

7.4.3 Ensure implementation of this SOP.

7.4.4 Ensure all students who will engage in strenuous physical training, or training involving protective masks, have approved medical releases from their sending organizations on file at the NTC prior to their beginning training.

NOTE: Ensure NTC training involving heavy activity over prolonged periods of time in hot weather is reviewed and approved by an exercise physiologist prior to implementation.

7.5 NTC Instructors

7.5.1 Ensure staff and students are not exposed to inclement weather hazards while undergoing training.

7.5.2 Postpone or cancel training when weather conditions so dictate.

7.5.3 Read and demonstrate compliance with this SOP.

7.5.4 Communicate the requirements of this SOP, including the potential hazards of inclement weather, to students and staff. During hot weather, the potential for heat-related injuries (to include exertional heat illness [EHI]) will be emphasized during pre-training safety briefings.

7.5.5 Identify an inclement weather shelter area prior to training, and advise students and observers of the shelter area location.

7.6 Students and Visitors

Students and visitors are responsible for following the directions of their instructors or escorts when inclement weather results in hazards to persons undergoing or observing training.

8.0 OPERATIONS

Although many of the procedures in this section are directed at NTC Instructors, the information applies to all employees, students, and visitors at NTC sites.

8.1 Overview

It is the goal of the NTC to conduct all training in an environment that is conducive to learning and free from hazards. Inclement weather can adversely affect the student's learning environment and expose NTC Instructors and students to weather-related hazards. NTC Instructors and staff must always be aware of potentially hazardous inclement weather conditions that can affect training, and must react quickly and properly to developing weather conditions that may expose students to hazards. Training activities will be postponed or cancelled when necessary.

Examples of inclement weather hazards include:

- Wet conditions
- Cold weather
- Hot weather
- High winds
- Weather obscured visibility
- Lightning

8.2 Wet Conditions

Lead Instructor: Rain, sleet, hail, or snow can create conditions that can cause unsafe environments for the conduct of firearms training, vehicle operations, or tactical training. Take the actions below to ensure safety for training in wet weather conditions.

8.2.1 Ensure you are aware of potential weather-related conditions that could adversely affect planned training.

8.2.2 Ensure alternate plans exist that can be implemented in the event heavy rain, snow, or sleet requires cancellation of planned training.

8.2.3 Inspect training areas that have been subjected to heavy rain, sleet, or snow to ensure the precipitation has not resulted in potentially unsafe training conditions.

8.2.4 Cease training activities when precipitation is such that any one of the following conditions exists:

- Students are unable to fire their weapons safely.
- Students' footing (stability) on a firing line is impaired.
- Students are unable to manipulate their weapons safely.
- Students' ability to see targets clearly is impaired.
- Students cannot operate vehicles safely due to condition of road or driving surfaces.
- Students cannot traverse tactical shooting courses, obstacle courses, land navigation courses, or other overland tactical courses safely.

8.3 Cold and Windy Weather

Lead Instructor: Extended exposure to cold and windy weather can degrade student performance and seriously affect training safety. Take the actions below to ensure safety for training in cold and windy weather conditions.

8.3.1 Ensure students who may train in a cold environment are properly clothed for the training and are accorded frequent rest breaks in warm areas. Ensure students drink water or warm nonalcoholic fluids regularly to prevent dehydration.

8.3.2 Ensure the ice and snow accumulations in, or on, training areas are removed so no one slips and falls.

8.3.3 Brief student on symptoms of frostbite and hypothermia prior to training and advise them on prevention measures.

8.3.4 Closely watch students to ensure they do not sustain frostbite or begin showing signs of hypothermia. Immediately remove any student from training whose performance or physical condition appears to be degraded by the cold weather. Suspected cases of cold injury will be referred to the Live Fire Range (LFR) Paramedic for examination and treatment.

8.3.5 Extended cold weather exposure can pose serious training safety hazards to students undergoing live-fire training. Use the Wind Chill Chart (Appendix A) to determine when all live-fire training should be suspended. Training may be conducted anywhere **inside the Light Blue area** shown on the left-hand side of the Wind Chill Chart. Once wind speed and ambient temperatures move into the two darker blue areas, or violet areas, on the right-hand side of the chart, terminate training and remove students from the training area.

Real-time wind chill data (wind speed, ambient temperature) may be secured and/or computed as follows:

A. Ask the LFR Safety Specialist to compute the LFR wind chill index using the portable weather station.

B. Call the 377th Air Base Wing 24-hour Automated Weather Observation System at 242-4044.

NOTE: Ambient temperatures are provided in degrees Celsius and wind speeds are provided in knots, and both require conversion to degrees Fahrenheit and miles per hour.

C. Go to the National Weather Service website at *http://www.nws.noaa.gov/om/windchill/index.shtml*, where the wind chill index can be automatically computed by entering local wind speed and ambient temperature.

NOTE: Ambient temperatures and wind speeds from these sources are those measured at the Albuquerque airport and may differ from conditions at the training venue.

8.4 Hot Weather

Lead Instructor: Hot dry weather at high altitude can have a rapid and deleterious effect on the human body, and quickly degrade student performance and training safety. The pre-training safety briefing must emphasize that the potential exists for heat-related injuries (to include EHI), and students will be briefed on the signs and symptoms of EHI. Take the actions below to ensure safety for training in hot weather conditions.

8.4.1 Ensure drinking water is always available at training locations. Water should be consumed regularly to prevent dehydration.

8.4.2 Establish shaded rest areas near training sites, and provide frequent rest periods. Encourage students to loosen or remove restrictive clothing during rest breaks.

8.4.3 Closely observe students to ensure signs of heat injury (heat exhaustion, heat cramps, or heat stroke) are not developing. Prior to training, brief students on the signs and symptoms of heat injury and the measures to take to reduce the possibility of heat injury. Encourage use of sunscreen and brimmed hats. Immediately remove students who exhibit any signs of heat injury from training and refer them to the LFR Paramedic for examination and treatment.

8.4.4 Continually observe student performance. If training performance is degraded due to extended exposure to high temperatures or the threat of heat injury exists, terminate training immediately and move the students to shaded or indoor areas.

8.4.5 Use the Heat Index Chart (Appendix B) and the Heat Index/Heat Disorder Chart (Appendix C) to determine if discontinuation of training is warranted. The LFR Safety Specialist can compute the heat index using the portable weather station.

NOTE: Training should not be conducted when the heat index is in the "EXTREME CAUTION" area of the Heat Index Chart (Appendix B).

8.4.6 Training that involves heavy physical activity over prolonged periods of time in the "EXTREME CAUTION" portion of the Heat Index Chart (Appendix B) will be reviewed and approved by the NTC Sports Physiologist under the "Heat Stress" criteria of ACGIH Threshold Limit Values and Biological Exposure Indices" prior to implementation (see Appendix D, Thermal Stress, for additional guidance.)

8.5 High Winds and Elevated Fire Conditions

Lead Instructor: Selected training may be dependent on prevailing wind speeds in a particular training area; for example, the U.S. Forest Service has wind speed restrictions on the use of pyrotechnics on Coyote Springs Road. Take the actions below to ensure safety for training in high wind conditions.

8.5.1 When strong winds interfere with the safe conduct of outdoor live-fire or ESS training, immediately halt the training, ensure all weapons are in a safe condition, and have students leave the training area.

8.5.2 On Coyote Springs Road/No Sweat Blvd, do not use pyrotechnics to support training if the wind speed exceeds 15 mph.

NOTE: Prevailing fire conditions may also preclude the use of pyrotechnics on Coyote Springs Road or No Sweat Blvd.

8.5.3 Suspend live-fire or ESS training on outside ranges or training areas when wind speed is 30 mph or higher.

NOTE: This does not apply to training inside either the Live Fire Shoot House or Tactical Training Tower nor does it apply to the inside areas of the ISSTEC facilities.

8.5.4 Suspend training on the exterior of the Tactical Training Tower if wind speeds exceed 20 mph.

8.5.5 Suspend all spark-producing and flame-producing cutting activities with torches and saws when wind speeds exceed 20 mph.

8.5.6 Ensure wind speed training limitations are never violated.

8.5.7 Ask the LFR Safety Specialist for immediate readings of wind speed using the portable weather station.

8.5.8 If training activities will be taking place at locations other than the LFR or ISSTEC (e.g., M-60 Range or "No Sweat" Boulevard), consult with the LFR Safety Specialist regarding fire danger and associated fire prevention measures.

8.6 Weather Obscured Visibility

Outside training will cease when dust, rain, snow, sleet, hail, fog, or other atmospheric conditions adversely affect the students' ability to see clearly and safely traverse terrain or handle vehicles, weapons, or equipment in a safe manner.

8.7 Lightning

Lead Instructor: Take the actions below to ensure safety for training during lightning conditions.

8.7.1 Postpone all outside training when lightning strikes within 3 miles (5 kilometers) of a training location.

8.7.2 Ensure all personnel immediately leave the training area, and seek shelter in a building or other covered facility.

8.7.3 Use the LFR portable lightning detectors to assist in determining if training should continue.

8.7.4 The LFR Safety Specialist shall assist the instructors in determining if thunderstorms are approaching the LFR or ISSTEC and if training activities should be curtailed. If thunderstorms are building in the area or are forecast, the LFR Safety Specialist will provide an alert to the Range Master and/or the ISSTEC Manager as appropriate.

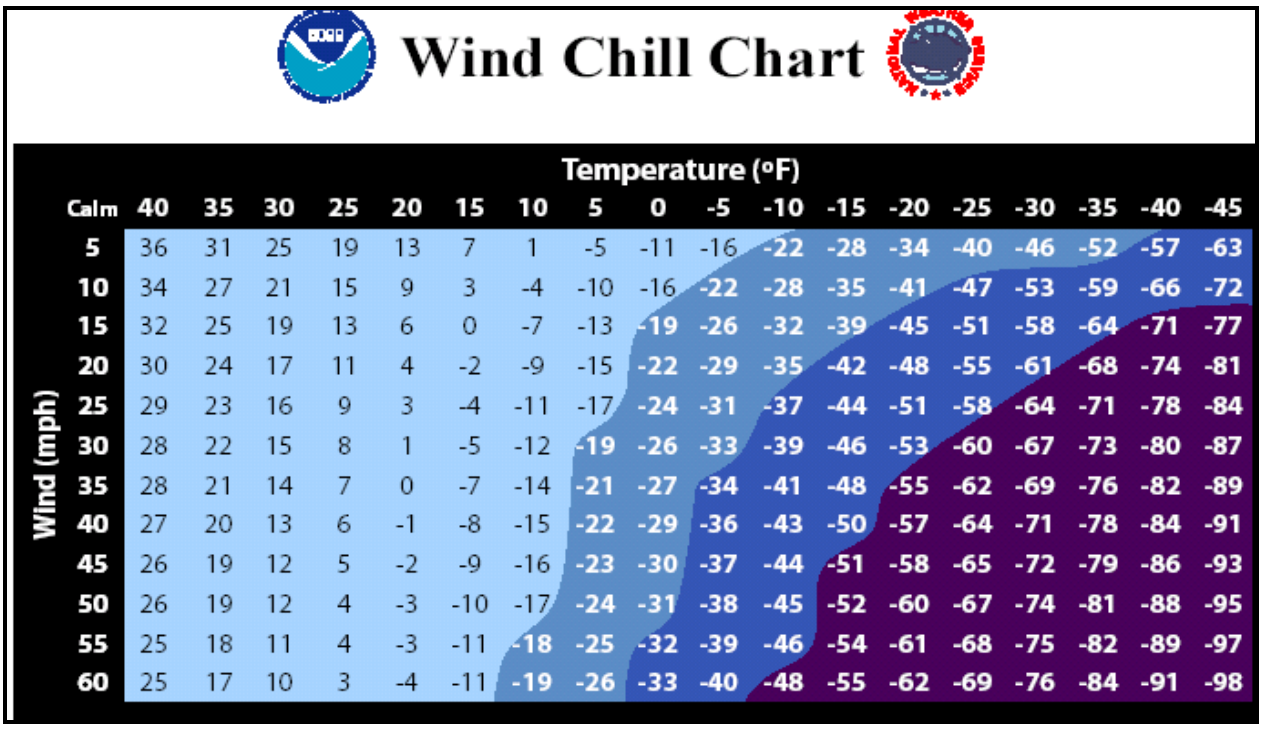
8.7.5 In the event there is no lightning detector at the training site, the senior instructor may determine the approximate distance of a lightning strike by counting the seconds between the lightning discharge flash and the audible report (thunder). Using an estimate of 5 seconds per mile, if 15 seconds or less have passed, lightning is considered to be in the immediate vicinity (within 3 miles) and training will be terminated.

8.7.6 Resume training if, within 30 minutes, no lightning strikes have occurred within 3 miles of the training area and the weather front appears to be moving away from the area.

9.0 APPENDICES

A – Wind Chill Chart
B – Heat Index Chart
C – Heat Index/Heat Disorder Chart
D – Thermal Stress

APPENDIX A – WIND CHILL CHART



Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

LIVE-FIRE TRAINING MAY BE CONDUCTED ANYWHERE WITHIN THE LIGHT BLUE AREAS ON THE LEFT SIDE OF THE CHART.

IF CONDITIONS MOVE THE WIND CHILL FACTOR INTO THE TWO DARKER BLUE AREAS OR VIOLET AREA, LIVE-FIRE TRAINING WILL BE TERMINATED.

APPENDIX B – HEAT INDEX CHART

Heat Index

Air Temp (°F)	Relative Humidity (percentage)																					
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
135°	120	126																				
130°	117	122	131																			
125°	111	116	123	131	141																	
120°	107	111	116	123	130	139	148															
115°	105	107	111	115	120	127	135	143	151													
110°	99	102	105	108	112	117	123	130	137	143	150											
105°	95	97	100	102	105	109	113	118	123	129	135	142	149									
100°	91	93	95	97	99	101	104	107	110	115	120	126	132	138	144	150						
95°	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136	140	150			
90°	83	84	85	86	87	88	90	91	93	95	96	98	100	102	106	109	113	117	122	126	131	
85°	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97	99	102	105	108	
80°	73	74	75	76	77	77	78	79	79	80	81	81	82	83	84	85	86	87	88	89	90	
75°	69	69	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78	79	79	80	
70°	64	64	65	65	66	66	67	67	68	68	69	69	70	70	70	70	71	71	71	71	72	

= **Heatstroke risk extremely high!**
EXTREME DANGER!
NO TRAINING!

= Heat exhaustion likely, heatstroke possible
DANGER!
NO TRAINING!

= Heat exhaustion possible
EXTREME CAUTION!

= Fatigue possible
CAUTION!

APPENDIX C – HEAT INDEX / HEAT DISORDER CHART

Heat Index	Possible Heat Disorders for People in Higher Risk Groups
130°F or higher	Heatstroke/sunstroke **highly likely** with continued exposure.
105°F - 130°F	Sunstroke, heat cramps, or heat exhaustion **likely**. Heatstroke **possible** with prolonged exposure and/or physical activity.
90°F - 105°F	Sunstroke, heat cramps, and heat exhaustion **possible** with prolonged exposure and/or physical activity.
80°F - 90°F	Fatigue **possible** with prolonged exposure and/or physical activity.

RECOMMENDED WATER INTAKE

Ambient Temperature	Work/Rest Cycle-Minutes	Water Intake (Quarts/Hour)
88°F - 91°F	Continuous	At Least 1.5
92°F - 94°F	50/10	At Least 2
95°F - 97°F	45/15	At Least 1
98°F - 99°F	40/20	At Least 1.5
100°F & above	30/30	More Than 2

NOTES:

1. Body armor/protective gear: You must add approximately 10°F to the heat index.
2. Chemical biological weapon (CBW) protective gear:
   a. If conducting easy work, add 10°F to the heat index.
   b. If conducting moderate or hard work, add 20°F to the heat index.
3. Work/rest cycle may be adjusted to the intensity of training.
4. Refer to portable weather meters for LFR temperature.
5. Rest cycle may include the following activities: Unscheduled pauses and administrative or operational waiting periods during work. Attempt to conduct rest periods in shaded areas.
6. If an employee is becoming excessively hot despite these limits, the employee will be removed from the work or training environment.

APPENDIX D – THERMAL STRESS

D.1 PURPOSE

This appendix provides the guidance, procedures, and minimum requirements for NTC employees to minimize the risk of heat/cold stress-related disorders. Risk minimization is accomplished by identifying risk factors, training individuals to know the proper signs and symptoms, and providing guidelines for preventing heat/cold stress disorders during NTC operations.

This appendix describes the emergency actions to be taken if an employee encounters another individual suffering from a thermal stress injury. The requirements described in this appendix are consistent with the thermal stress standards in the "2006 Threshold Limit Values (TLVs) for Chemical and Physical Agents and Biological Exposure Indices (BEIs)" by the American Conference of Government Industrial Hygienists (ACGIH).

D.2 SCOPE

This appendix applies to all NTC employees who engage in strenuous physical activities and may be exposed to thermal stress hazards.

D.3 RESPONSIBILITIES

D.3.1 DOE/NTC Director

Responsible for ensuring all training is safely performed under all thermal stress conditions.

D.3.2 PFT Manager

Responsible for ensuring that all PFT Instructors are familiar with and comply with requirements of PFT-SOP-652, *Inclement Weather Training Restrictions*. The PFT Manager will further ensure:

1. An individual with expertise in exercise physiology is included in the planning and implementation of NTC training that involves rigorous physical demands.

2. The design of training regimens balances physical rigor with the safety of the participants.

D.3.3 PFTD Instructors

Responsible for considering thermal stress factors when training in hot or cold weather.

NOTE: Instructors will consider a person acclimated if they have been living in the Albuquerque area for longer than one month. Personnel attending training that are not assigned to the Albuquerque area will be identified and observed more frequently.

1. Training with moderate activity in moderate conditions. Examples of this training may include stationary/qualification shooting while on LFR ranges. At a minimum, PFTD Instructors will perform the following actions:

a. Pay attention to possible heat problems, signs, and symptoms experienced by students or instructors.

b. Provide an adequate amount of water at all times.

c. Recommend water consumption at 1 pint or more per person per hour.

d. Allow for water consumption at 20- to 30-minute intervals.

e. Recommend avoiding salt intake.

f. Recommend avoiding heavy meals during training.

g. Recommend use of nonrestrictive clothing or equipment while in training.

h. Refer to heat index chart as a guide to conducting rest/work cycle.

2. Training with strenuous activity in moderate to hot conditions. Hot conditions will be based on ambient temperatures for a person acclimated to the Albuquerque region. Examples of this training are individual/tactical movement techniques. At a minimum, PFTD Instructors will perform the following actions:

a. Identify non-acclimated personnel.

b. Provide an adequate amount of water at all times.

c. Recommend water consumption of no more than 12 quarts per person per day.

d. Allow for frequent water consumption at intervals of 10 to 15 minutes.

e. Recommend avoiding salt intake.

f. Recommend use of nonrestrictive clothing or equipment while in training.

g. Refer to heat index chart as a guide to conducting rest/work cycle.

D.3.4 NTC Exercise Physiologist

Responsible for providing:

1. Technical expertise in exercise physiology to assist in the planning and implementation of training programs that involve rigorous physical demands.

2. Technical expertise to assist with the design of training programs that balance physical rigor with the safety of the participants.

D.3.5 ES&H Staff

Responsible for providing:

1. Professional assistance in determining and recommending specific heat/cold stress controls.

2. Technical assistance and guidance to employees and supervisors in the application of federal law, applicable standards, DOE directives, and NTC policies, plans, and procedures.

3. Assist Lead Instructor, as requested, with initial safety orientation (including thermal stress information) to students attending training at the NTC.

D.3.6 Logistics Manager

Responsible for:

1. Procuring and maintaining sufficient required personal protective equipment (PPE) to support NTC training.

2. Ensuring that all training and administrative vehicles have properly operating heating/cooling systems.

3. Notifying appropriate NTC managers of any equipment shortfalls or failures.

D.3.7 NTC Managers and Supervisors

Responsible for employee safety and for ensuring employees are protected from occupational exposure to thermal stress hazards associated with their duties. Supervisors will ensure:

1. Clear roles and responsibilities are identified in NTC policies, plans, and procedures, and guidance for the prevention and control of thermal stress is included.

2. Employees performing work involving strenuous activities when conducting daily operations possess the knowledge, skills, and abilities necessary to carry out their responsibilities.

3. Required training has been identified for personnel assigned to strenuous duties or operations in thermal stress environments.

4. Training has qualified employees to perform assigned tasks safely and efficiently.

5. Employees can perform required emergency duties.

6. Employees are provided necessary on-the-job training.

7. Employee training is continuously updated.

8. Inspection schedules/intervals are established for PPE used by employees.

9. Operations have been analyzed to determine types of PPE that must be worn by personnel working in thermal stress environments.

10. Employees must be provided with, and trained in the use of, required PPE.

11. NTC management is notified of any thermal stress safety concerns that cannot be adequately resolved.

12. Potential exposure to thermal stress hazards associated with training are identified during the training development process.

13. Hazard controls are developed to minimize occupational exposure to thermal stress hazards and are tailored to work or training to be performed.

14. ES&H personnel are notified when there are changes in the thermal stress factors, including controls and personal equipment changes.

D.3.8 Employees

Responsible for:

1. Attending required training prior to conducting heavy, strenuous work or other physical activity in support of NTC training operations.

2. Understanding and complying with the policies and procedures contained in this appendix, and performing work within the specified thermal stress controls.

3. Developing, maintaining, and understanding the need for a safe work attitude when conducting strenuous activities.

4. Understanding potential thermal stress hazards involved in day-to-day operations.

5. Providing feedback on the adequacy of thermal stress controls, and reporting potential hazards or improvement opportunities involving occupational exposure to thermal stress hazards during the workday.

6. Notifying their immediate supervisor of any thermal stress safety concerns that cannot be resolved.

D.4 OVERVIEW

D.4.1 Thermal Stress

D.4.1.1 Controls

The five major types of engineering controls used to reduce heat stress in hot work environments are ventilation, air cooling, fans, shielding, and insulation. Heat reduction can also be achieved by using equipment and tools that reduce the physical demands placed on an employee. However, for this approach to be successful, the metabolic effort required for the employee to use or operate these devices must be less than the effort required without them. Another method is to reduce the effort necessary to operate equipment such as power assists. The individual should be allowed to take frequent rest breaks in a cooler environment.

D.4.1.2 Acclimatization

The human body can adapt to heat exposure to some extent. This physiological adaptation is called *acclimatization*. After a period of acclimatization, the same activity will produce fewer cardiovascular demands. The individual will sweat more efficiently (causing better evaporative cooling), and thus will more easily be able to maintain normal body temperatures.

A properly designed and applied acclimatization program decreases the risk of heat-related illnesses. Such a program basically involves exposing employees to work in a hot environment for progressively longer periods. According to the National Institute for Occupational Safety and Health (NIOSH), employees who have had previous experience in jobs where heat levels are high enough to produce heat stress, the regimen should be 50 percent exposure on Day 1, 60 percent on Day 2, 80 percent on Day 3, and 100 percent on Day 4. For new employees who will be similarly exposed, the regimen should be 20 percent exposure on Day 1, with a 20 percent increase in exposure each additional day.

D.4.1.3 Fluid Replacement

Cool (50°-60°F) water or any cool liquid (except alcoholic beverages) should be made available to employees to encourage them to drink small amounts frequently (such as one cup every 20 minutes). Ample supplies of liquids should be placed close to the work area. Although some commercial replacement drinks contain salt, this is not necessary for acclimatized individuals because most people add enough salt to their summer diets.

D.4.1.4 Engineering Controls

1. General ventilation is used to dilute hot air with cooler air (generally cooler air that is brought in from the outside). This technique clearly works better in cooler climates than in hot ones. A permanently installed ventilation system usually handles large areas or entire buildings. Portable or local exhaust systems may be more effective or practical in smaller areas.

2. Air treatment/air cooling differs from ventilation because it reduces the temperature of the air by removing heat (and sometimes humidity) from the air.

3. Air conditioning is a method of air cooling, but it is expensive to install and operate. An alternative to air conditioning is the use of chillers to circulate cool water through heat exchangers over which air from the ventilation system is then passed. Chillers are more efficient in cooler climates or in dry climates where evaporative cooling can be used.

4. Local air cooling can be effective in reducing air temperature in specific areas. Two methods have been used successfully in industrial settings. One type, cool rooms, can be used to enclose a specific workplace or to offer a recovery area near hot jobs. The second type is a portable blower with built-in air chiller. The main advantage of a blower, aside from portability, is minimal set-up time.

5. Another way to reduce heat stress is to increase the air flow or convection using fans, etc. in the work area (as long as the air temperature is less than the employee's skin temperature). Changes in air speed can help employees stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air) and the rate of evaporation. Because this method does not actually cool the air, any increases in air speed must impact the employee directly to be effective.

   NOTE: If the dry bulb temperature is higher than 35°C (95°F), the hot air passing over the skin can actually make the individual hotter. When the temperature is more than 35°C and the air is dry, evaporative cooling may be improved by air movement, although this improvement will be offset by the convective heat. When the temperature exceeds 35°C and the relative humidity is 100%, air movement will make the individual hotter. Increases in air speed have no effect on the body temperature of individuals wearing vapor-barrier clothing.

6. Heat conduction methods include insulating the hot surface that generates the heat and changing the surface itself.

7. Simple engineering controls such as shields can be used to reduce radiant heat (i.e., heat coming from hot surfaces within the individual's line of sight). Surfaces that exceed 35°C (95°F) are sources of infrared radiation that can add to the individual's heat load. Flat, black surfaces absorb heat more than smooth, polished ones. Having cooler surfaces surrounding the individual assists in cooling because the individual's body radiates heat toward them.

   NOTE: With some sources of radiation such as heating pipes, it is possible to use both insulation and surface modifications to achieve a substantial reduction in radiant heat. Instead of reducing radiation from the source, shielding can be used to interrupt the path between the source and the individual. Polished surfaces make the best barriers, although special glass or metal mesh surfaces can be used if visibility is a problem.

8. Shields should be located so they do not interfere with air flow, unless they are also being used to reduce convective heating. The reflective surface of the shield should be kept clean to maintain its effectiveness.

D.4.1.5 Administrative Controls and Work Practices

1. Training is the key to good work practices. Unless all employees understand the reasons for using new, or changing old, work practices, the chances of such a program succeeding are greatly reduced.

2. NIOSH states that a good heat stress training program should include (at least) the following components:

   - Knowledge of the hazards of heat stress;
   - Recognition of predisposing factors, danger signs, and symptoms;

- Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
- Employee responsibilities in avoiding heat stress;
- Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
- Use of protective clothing and equipment; and
- Purpose and coverage of environmental and medical surveillance programs and the advantages of employee participation in such programs.

3. Hot jobs should be scheduled for the cooler part of the day. Routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.

D.4.1.6 Monitoring Programs

1. Every individual who works in extraordinary conditions that increase the risk of heat stress should be personally monitored. These conditions include wearing semi-permeable or impermeable clothing when the temperature exceeds 21°C (69.8°F) or working at extreme metabolic loads (greater than 500 kcal/hour), etc.

2. Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.

3. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one-third and maintain the same rest period.

4. The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (P1) with the pulse rate taken at 2.5 minutes (P3) after the rest break starts. The two pulse rates can be interpreted using the table below.

Heart Rate Recovery Criteria

Heart rate recovery pattern	***P_3***	***Difference bet. P_1 and P_3***
Satisfactory recovery	<90	--
High recovery (conditions may require further study)	90	10
No recovery (may indicate too much stress)	90	<10

5. Oral temperature can be checked with a clinical thermometer after work but before the individual drinks water. If the oral temperature taken under the tongue exceeds 37.6°C, shorten the next work cycle by one-third.

6. Body water loss can be measured by weighing the individual on a scale at the beginning and end of each work day. The individual's weight loss should not exceed 1.5% of total body weight in a workday. If a weight loss exceeding this amount is observed, fluid intake should increase.

D.4.1.7 Other Administrative Controls

The following administrative controls can be used to reduce heat stress:

- Reduce the physical demands of work (e.g., excessive lifting or digging with heavy objects);
- Provide recovery areas (e.g., air-conditioned enclosures and rooms);
- Use shifts (e.g., early morning, cool part of the day, or night work);
- Use intermittent rest periods with water breaks;
- Use relief workers;
- Use employee pacing;
- Assign extra employees; and
- Understand the proper response toward "imminent danger". One of the most important aspects of good thermal stress program is for employees to know when an operation should be stopped and being empowered to do so. Some of the reasons to suspend an operation are significant environmental impact, personnel endangerment, quality problems, or the inability to follow standards. All employees are empowered to suspend operations.

D.4.2 Heat Stress

D.4.2.1 General Information

1. Hot weather is probably the single greatest hazard facing runners. With the exception of an automobile accident, running in hot weather is the quickest way to die.
2. Outdoor operations conducted in hot weather, especially those that require employees to wear semi permeable or impermeable protective clothing, are also likely to cause increased employee heat stress.
3. The body has two closely related defenses against heat: temperature control thermo-regulation and salt and water regulation.
4. Under hot conditions, sweating is the most important way the body cools itself. Veins in the skin dilate and blood is shunted to the body's surface, bringing heat with it. A sweating response occurs and the body heat is lost by evaporation of sweat.
5. One liter of sweat weighs approximately 2.2 pounds; therefore, a runner who loses 2-3 liters of sweat an hour will rapidly become dehydrated. If fluid losses are not replaced, body cooling cannot continue. Even a 2 percent decrease in hydration can result in a decrease in performance.

6. The heart must work harder in hot weather. For example, a runner's heart rate may be 120 while running a 6-minute mile at 60°F. When the temperature reaches 90°F, the same runner's heart rate may be 160 while he runs an identical 6-minute mile.

7. Loss of body water is a critical danger. Sodium and potassium losses can occur, especially over a period of several days or weeks of hot weather running. Therefore, ensure that intake is increased.

8. Heat acclimatization occurs after several days of exercising in hot climates. Body changes occur that help maintain low body temperature during exercise. These adaptations include an increased sweating rate; an increase in blood water content of plasma volume, allowing extra reserve of fluid for sweating; an increased blood flow to the skin in response to heat; and a decreased rate of muscle glycogen use and salt losses. The end result of heat acclimatization is the maintenance of lower body temperature during exercise, fatigue will be delayed, heart rate will lower, and the natural thirst mechanism will be more accurate.

WARNING: Never ignore the signs or symptoms of heat-related disorders!

D.4.2.2 Causal Factors

1. Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. However, even the type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.

2. It is difficult to predict who will be affected and when because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

3. The following predisposing medical conditions add to the risk of heat illness:

   - Malignant Hyperthermia – can lead to muscle rigidity, resulting in elevated body temperatures from the accelerated metabolic rate in the skeletal muscle.

   - Neuroleptic Malignant Syndrome – associated with use of neuroleptic agents and antipsychotic drugs and an unexpected idiopathic increase in core temperature during exercise.

   - Arteriosclerotic Vascular Disease – compromises cardiac output and blood flow through the vascular system by thickening arterial walls.

   - Scleroderma – skin disorder that decreases sweat production, thereby decreasing heat transfer.

- Cystic Fibrosis – causes increased salt loss in sweat and can increase risk of hyponatremia.

- Sickle Cell Trait – limits blood-flow distribution and decreases oxygen-carrying capacity. The condition is exacerbated at higher altitudes.

D.4.2.3 Heat Fatigue

A factor that predisposes an individual to heat fatigue is lack of acclimatization. The use of a program of acclimatization and training for work in hot environments is advisable. The signs and symptoms of heat fatigue include impaired performance of skilled motorsensory, mental, or vigilance jobs. There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

D.4.2.4 Heat Rashes

Heat rash is the most common problem in hot work environments. Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by un-evaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

D.4.2.5 Heat Collapse (Fainting)

1. In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable. To prevent heat collapse, the employee should gradually become acclimatized to the hot environment.

2. Symptoms include decreased blood pressure due to vasodilation and pooling of blood in the peripheral vessels. There is profuse sweating and an abnormally high heart rate. Body temperature is generally normal.

3. First Aid: Lie the victim down, elevate feet to increase blood flow to the brain, and get the person out of the heat.

D.4.2.6 Heat Cramps

1. Heat cramps involve muscular pains and spasms, usually in the active muscles, due largely to loss of salt from the body in sweating or to inadequate intake of salt. This is the lowest level of heat illness and is not a medical emergency. Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused by both too much and too little salt. Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution, excess salt can build up in the body if the water lost through sweating is not replaced. Thirst

cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments. Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Recent studies have shown that drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

2. Symptoms manifest themselves especially affecting the muscles of the legs and abdomen. Another symptom is fatigue. Body temperature is normal.

3. First Aid: Exert firm pressure with your hands on the cramped muscle or gently massage them to help relieve the spasm. Give the victim sips of salt water (one teaspoon of salt per glass), half a glass every 15 minutes over a period of about one hour. Plain water is acceptable if no salt is available.

D.4.2.7 Heat Exhaustion

1. A response to heat characterized by fatigue, weakness, and collapse due to intake of water, inadequate to compensate for loss of fluids through sweating. The signs and symptoms of heat exhaustion are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, a medical emergency.

2. Symptoms include approximately normal body temperature, pale, cool and clammy skin, profuse perspiration, tiredness, thirst, weakness, headache (perhaps cramps), nausea (dizziness), and possible fainting.

3. First Aid: Give the victim sips of water (one teaspoon of salt per glass) every 15 minutes over a period of one hour. Plain water is acceptable if no salt is available. Have the victim lie down and raise his feet 8-12 inches, loosen clothing, apply cool, wet cloths and fan the victim or move him to an air-conditioned room. If the victim vomits, do not give him additional fluids. Get the victim to a hospital immediately where an intravenous salt solution can be administered. The victim should not return to work for several days and should be protected from exposure to abnormally warm temperatures.

D.4.2.8 Heat Stroke (Immediate Medical Emergency)

1. Heat stroke occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. Heat stroke is an immediate, life-threatening emergency for which medical care is urgently needed.

2. Symptoms of heat stroke include confusion, irrational behavior, loss of consciousness, convulsions, lack of sweating (usually), hot/dry skin, and/or high body temperature (may be 106°F or higher).

3. First Aid: Immediate measures should be taken to cool the body quickly. Once the victim's temperature is reduced to below 102°F, care should be taken to prevent over-chilling the body. The following first aid measures are applicable whenever the body temperature reaches 105°F:

   Call for professional medical help, then:

   a. Undress the victim and repeatedly sponge the bare skin with cool water or rubbing alcohol, OR

   b. Apply cold packs continuously, OR

   c. Place the victim in a tub of cold water (do not add ice) until his temperature is lowered sufficiently. When the victim's temperature has been reduced enough, dry him off.

   WARNING #1: Regardless of his/her protests, no individual suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

   WARNING #2: Never ignore signs or symptoms of heat-related disorders.

D.4.2.9 Exertional Heat Illness (EHI)

1. EHI has been recognized as a substantial problem in military operations and training. It is a fairly common illness in healthy young adults undergoing strenuous physical training in warm and humid weather. EHI arises from sustained or heavy exertion, usually in hot environment. Typically, onset is abrupt, occurring during or shortly after exertion, with orthostatic manifestations (faintness, staggering, or visual disturbance) leading to events such as collapse, confusion, and delirium. EHI is significantly different from the classic heat illness that is typically associated with extended exposure to a hot environment and that primarily impacts older people or those with weak cardiovascular reserve.

2. The most severe cases of EHI, similar to those in classical heat illness, are categorized as exertional heatstroke, exertional heat injury, and exertional heat exhaustion.

   a. Exertional heatstroke: Characterized by early, severe, non-focal encephalopathy (neurological disturbance) with hyperthermia (increase in core temperature).

   b. Exertional heat injury: A progressive multi-system disorder, with hyperthermia accompanied by organ damage or severe dysfunction (e.g., metabolic acidosis, acute renal failure, or muscle necrosis).

   c. Exertional heat exhaustion: A reversible, non-life-threatening multi-system disorder reflecting the inability of the circulatory system to meet the demands of thermoregulatory, muscular, cutaneous, and visceral blood flow.

3. EHI requires urgent diagnosis and treatment. Although severe cases of EHI constitute clear medical emergencies, patients with EHI at milder levels also require urgent and aggressive management to avoid progression. Specifically,

   (1) In controlled settings, emergency medical care for EHI should be arranged in advance;

   (2) If transportation to an emergency department requires more than 5 to 10 minutes, provisions should be made for administering intravenous fluids en route; and

   (3) At least one paramedic should be present on site while strenuous training is conducted. When emergency vehicles leave the training site, strenuous activities should be stopped until medical support and transport are again available.

D.4.3 Preventative Measures for Heat Illness

A. Heat acclimatization – to achieve full heat acclimatization a person must exercise in the heat for approximately *2 full weeks*. Partial acclimatization occurs otherwise. Fit individuals tend to acclimatize quicker and have a better tolerance to heat.

B. Decrease intensity and duration of exercise in order to maintain the same prescription heart rate. Monitor the individuals much more frequently when they exercise in hot weather (i.e., take their heart rate during the initial phase of the work-out and periodically throughout, when initially exercising in the heat). The heart rate will show dehydration, environmental heat load and lack of acclimatization.

C. Ensure adequate water replacement, and educate personnel on the importance of increased water intake during exercise in the heat. Schedule 15-20 minutes prior to exercise: 10-16 ounces of water during exercise and every 10-15 minutes ingest 6-10 ounces. Weigh pre- and post-exercise to know how much water needs to be replaced (one pint for every pound lost).

   WARNING: Daily fluid intake should not exceed 12 quarts unless directed by a medical doctor.

D. Clothing should be as brief as possible, loosely weaved, natural fiber and of a light color since dark colors absorb heat while light clothes reflect it.

E. Exercise during the heat of the day should be avoided. Early morning and late evening are the most desirable times to exercise in order to avoid the direct radiation of the sun.

F. Know the warning signs of heat illness.

G. Follow National Weather Service Heat Index Charts (Appendices B and C in this SOP).

Recommended Water Intake

Ambient Temperature	Work/Rest Cycle-Minutes	Water Intake (Quarts/Hour)
88°F - 91°F	Continuous	At Least 1.5
92°F - 94°F	50/10	At Least 2
95°F - 97°F	45/15	At Least 1
98°F - 99°F	40/20	At Least 1.5
100°F & above	30/30	More Than 2

NOTES:

1. Body armor/protective gear: you must add approximately 10°F to the heat index.
2. CBW protective gear:
   a. If conducting easy work, add 10°F to the heat index.
   b. If conducting moderate or hard work, add 20°F to the heat index.
3. Work/rest cycle may be adjusted to the intensity of training.
4. Refer to portable weather meters for LFR temperature.
5. Rest cycle may include the following activities: Unscheduled pauses and administrative or operational waiting periods during work. Attempt to conduct rest periods in shaded areas.
6. If an employee is becoming excessively hot despite these limits, the employee will be removed from the work or training environment.

D.4.4 Cold Weather

D.4.4.1 Introduction

A comprehensive cold weather injury prevention and management program will follow the principles of Integrated Safety Management (ISM) by identifying hazards, assessing the hazards in terms of severity and probability, and implementing appropriate controls to abate the hazards. Spot-checking and supervision by first-line leaders must be employed to ensure control measures are being implemented. Units train using risk-management principles; therefore, supervisors will apply the same framework to prevent cold weather injuries. Cold-casualty prevention is a line management responsibility. This section provides information that will assist in presenting cold weather injury prevention in the ISM format.

D.4.4.2 Analyze the Hazards

Cold weather may present a hazard if any one of the following is present:

1. Cold (temperature 40°F and below).
2. Wetness (rain, snow, ice, humidity) or wet clothes at temperatures below 60°F.
3. Wind (wind speed 5 mph and higher).
4. Lack of adequate shelter/clothing.
5. Lack of provisions/water.
6 Other risk factors, such as
   a. Previous cold injuries or other significant injuries.
   b. Use of tobacco/nicotine or alcohol.
   c. Skipping meals/poor nutrition.
   d. Low activity.
   e. Fatigue/sleep deprivation.
   f. Little experience/training in cold weather operations.
   g. Cold casualties (not reported) in the previous 2 to 3 days.

D.4.4.3 Assessing the Hazards

The potential for cold casualties can be assessed by determining:

1. The magnitude of cold exposure. Reliable measurement equipment must be used to determine:

    - Air temperature (thermometer).
    - Wind speed (anemometer).
    - Wetness.
    - Weather forecast (local weather station or another source such as the worldwide web).

2. NTC employees must have:

    - Proper clothing in good condition, clean and without stains, holes or blemishes that could decrease the insulation.
    - Adequate shelter.
    - Proper fitness.
    - Proper food and hydration.

3. Related concerns, including:

    - Degree of mobility, which impacts on an individual's heat generation.
    - Contact with ground or other surfaces that may increase conductive cooling.
    - Exposure to wet conditions (e.g., rain, snow, sleet).

D.4.4.4 Develop and Implement Hazard Controls

1. Cold casualties can be controlled through education.

    a. Employee education should include:

        - Assessing cold stress.
        - Recognizing and preventing cold injuries.
        - Limiting the effects of cold through clothing, shelter, and nutrition.
        - Learning how to work effectively in cold environments.

    b. Manager education should include:

        - Supervising employees who often have only a superficial understanding of cold.
        - Evaluating the impact of cold on the mission (for example, everything takes longer and people will become more fatigued and more likely to make mistakes).

c. Experiential learning should include:

- Remembering that true effectiveness in cold environments only comes with experience.
- Practicing the clothing principles of layering and staying dry. These principles must be tailored to the individual, and must be practiced so they will learn when to dress down (before sweating begins) and when to add layers (before shivering begins).
- Using equipment in the cold. Everything takes longer, so practice is needed. Employees need to be able to identify where special tools or clothing (e.g., contact gloves) may be necessary.
- Planning for longer sessions (weather may change quickly and hinder operations, and fatigue impacts even routine operations).

2. The posting of cold-casualty prevention information as an ongoing reminder.

3. Establishing SOPs for most routines.

4. Training

a. Clothing should be appropriate and worn properly.

- Clothing must be kept dry, and wet, damp clothes changed as soon as possible.
- Clothing is to be worn loose and in layers, and hands, fingers, and the head are to be covered and protected.
- All clothing must be clean and in good repair (no broken zippers or holes).
- Proper footgear must be worn that are not too tight and are dry.
- Socks must be clean and dry. Wet or damp socks must be changed as soon as possible, and foot powder should be used on feet and boots.
- Gloves or mittens are to be worn.
- Hands should be warmed under clothes before hands become numb.
- Skin contact with snow, fuel, or bare metal is to be avoided. Proper gloves should be worn when handling fuel or bare metal.
- Gloves should be waterproofed by treating them with waterproofing compounds.
- Face and ears should be covered with a scarf or an insulated cap with flaps over the ears, or a balaclava.

- Face and ears should warmed by covering them with the hands; the face and ears should not be rubbed.
- Face camouflage should not be applied when the air temperature is below 32ºF.
- Sunscreen should to be worn.
- Sunglasses should be worn to prevent snow blindness.

b. The body must be kept warm:

- Employees and students should keep moving.
- Large body muscles should be exercised to keep warm.

c. Health and nutrition should be sustained:

- Alcohol use is to be avoided - alcohol impairs the body's ability to shiver.
- Tobacco products are to be avoided - tobacco products decrease blood flow to the skin.
- Regular meals should be eaten to maintain energy.
- Water or warm nonalcoholic fluids should to be drunk regularly to prevent dehydration.
- Carbon monoxide poisoning can be prevented by using only DOE-approved heaters in confined areas.

d. NTC employees should protect each other. NTC employees must be alert to signs of frostbite and other cold weather injuries.

e. Leadership initiatives should be practiced:

- Work activities or training should be limited or discontinued during very cold weather.
- Enclosed heated vehicles should to be used for transport.
- Warming areas should be made available.
- Ensure rest breaks, warming breaks, and meal breaks are observed.
- Ensure all equipment is working properly.

D.4.4.5 Perform Work Within Controls

1. Cold casualty controls
    - Controls must be defined and in place.
    - Controls must be integrated into SOPs.
2. Employees must be educated on workplace hazards and controls.
3. Employees must be encouraged to speak up about potential problems.
4. Risk is accepted at the appropriate level.

D.4.4.6 Provide Feedback and Continuous Improvement

The final step in the ISM function process is the supervision and evaluation of the controls taken to prevent cold casualties. Examples are:

1. Ensuring all personnel are educated in the prevention, recognition, and treatment of cold-weather injuries.
2. Delegating responsibilities to ensure cold-weather control measures are implemented.
3. Monitoring the adequacy/progress of implementation of control measures.
4. Performing spot checks of rest and warming areas, and water supplies.
5. Recording and monitoring indicators of increasing cold risks, such as:
    - An increase in the number of cold-weather injuries.
    - An increase in the number of complaints/comments about cold.
    - Observations of excessive shivering or signs of cold-weather injuries.
6. Continuously evaluating current control measures and formulating new ways to keep warm and avoid cold injuries.

D.4.4.7 Measures for Exercising in the Cold

1. Dress in layers. Start exercising a little cool, then as you warm, unzip or remove a layer of clothes. Wear a hat. Most of the body's heat will be lost through the head. The clothing next to the skin should be made of synthetic fibers so it will keep moisture away from the skin.
2. Drink water. Even during cold weather exercise, the body loses a lot of water. Make sure you keep hydrated.

3. When you start, if possible head into the wind. This way on your return, when you are most sweaty, the wind will be at your back.

4. Be aware of slippery surfaces.

5. Cold air can trigger asthma in some people with this medical condition. A scarf or face mask can help.

6. Move indoors if it is too cold.

7. Avoid alcohol, this dilates the blood vessels and causes more heat to be lost.

8. Shivering is a good warning sign to get indoors.

9. Be aware of wind chill. The real "coldness" of the temperature is a combination of temperature and wind speed. See Wind Chill Chart at Appendix A.

D.5 PROCEDURES

D.5.1 Heat Stress

NOTE: The ACGIH states that workers should not be permitted to work when their deep body temperature exceeds 38°C (100.4°F).

1. Supervisors will obtain the current temperature and humidity conditions prior to strenuous outdoor activity.

2. Supervisors will consult heat index charts (Appendices B and C in this SOP) and determine appropriate controls.

3. Supervisors will provide appropriate controls to employees prior to participation in strenuous outdoor activities.

4. Individual job tasks, employee variability, and environmental conditions will be considered when evaluating recommendations for heat stress management.

5. Non-acclimated personnel should be gradually introduced to strenuous work/activity in hot environments.

6. Consideration should be given to rescheduling strenuous work/activity for the coolest part of the day during hot weather.

7. Supervisors should consider reassigning personnel at a higher risk for developing a heat stress disorder to less strenuous work/activity. Supervisors should closely monitor these individuals.

8. When practical, supervisors will establish cool rest areas in shaded or air-conditioned locations.

9. Supervisors will encourage employees to drink water before beginning strenuous work/activity and throughout the work/activity.

10. Water will be readily available prior to and during strenuous work/activity.

11. Employees should be able to recognize signs and symptoms of heat stress in themselves and their co-workers (see Heat Index/Disorder Chart at Appendix C).

12. Predisposing factors for the development of a heat stress-related disorder include:

    - Feverish condition
    - Reactions to immunizations
    - Vascular diseases
    - Conditions affecting sweat secretion – skin burns
    - Skin trauma, such as heat rash or acute sunburn or reaction to poison ivy/oak.
    - Previous occurrence of heat injury
    - Dehydration
    - Lack of sleep
    - Recent alcohol intake
    - Dieting
    - Some medications (e.g., antihistamines)

    NOTE: Knowledge of past experience with the work environment, specific tasks to be performed, and degree of acclimatization can be very valuable when applying recommended guidelines to specific work situations.

D.5.2 Cold Stress

1. Supervisors will get temperature and wind chill information prior to outdoor activities.

2. Supervisors will consult the Wind Chill Index (Appendix A) and determine appropriate controls.

3. Supervisors will provide appropriate controls to employees.

4. At air temperatures of 35°F or less, employees whose clothing becomes wet should be provided a change of clothing and treated for hypothermia.

5. Employees handling evaporative liquids (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 39.2°F should take precautions to avoid wetting clothing or gloves with the liquids due the added danger of cold stress due to evaporative cooling.

6. Employees should be able to recognize signs and symptoms of cold stress in themselves and their co-workers (see Wind Chill Chart at Appendix A).

7. Predisposing factors for the development of cold stress include:

    a. Older employees or employees who have diagnosed chronic circulatory problems that can affect feet and extremities.

    b. Employees inexperienced with cold climates.

c. Employees on medications affecting the circulatory system (e.g., heart medications or blood thinners).

d. Employees who have a diagnosed disease (e.g., cardiovascular disease, diabetes, or hypertension) that interferes with normal body temperatures or reduces tolerance to work/activity in cold environments.

8. Consideration should be given to rescheduling strenuous work/activity for the warmest part of the day during cold weather.

9. During cold weather, warming areas should be established.

D.6 DEFINITIONS

1. ACCLIMATIZATION. A series of physiological and psychological adjustments that occur in an individual during the first week of exposure to hot environmental conditions.

2. CALORIE. The amount of heat required to raise 1 gram of water 1°C (based on a standard temperature of 16.5°C–17.5°C).

3. CONDUCTION. The transfer of heat between materials that contact each other. Heat passes from the warmer material to the cooler material. For example, a worker's skin can transfer heat to a contacting surface if that surface is cooler, and vice versa.

4. CONVECTION. The transfer of heat in a moving fluid. Air flowing past the body can cool the body if the air temperature is cool. On the other hand, air that exceeds 35°C (95°F) can increase the heat load on the body.

5. DRY BULB (DB) TEMPERATURE. Measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources.

6. EVAPORATIVE COOLING. Occurs when sweat evaporates from the skin. High humidity reduces the rate of evaporation and thus reduces the effectiveness of the body's primary cooling mechanism.

7. GLOBE TEMPERATURE. The temperature inside a blackened, hollow, thin copper globe.

8. HEAT. A measure of energy in terms of quantity.

9. HEAT STRESS. The net heat load on the body from the combined contribution of metabolic production and external environmental factors.

10. METABOLIC HEAT. A by-product of the body's activity.

11. NATURAL WET BULB (NWB) TEMPERATURE. Measured by exposing a wet sensor, such as a wet cotton wick fitted over the bulb of a thermometer, to the effects of evaporation and convection. The term natural refers to the movement of air around the sensor.

12. RADIATION. The transfer of heat energy through space. A worker whose body temperature is greater than the temperature of the surrounding surfaces radiates HEAT to these surfaces. Hot surfaces and infrared light sources radiate heat that can increase the body's heat load.

13. STRENUOUS ACTIVITY. A movement or series of movements requiring or characterized by great effort, energy or exertion (e.g., Qualification run, Pursuit Recapture, and Training in Level B PPE).

14. WIND CHILL. A function of the air temperature and wind velocity upon the exposed body.

D.7 ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
°F	Degrees Fahrenheit
EHI	Exertional heat illness
ES&H	Environment, safety, and health
NIOSH	National Institute for Occupational Safety and Health
PPE	Personal protective equipment
RH	Relative humidity
TLV	Threshold limit value

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